



**COMMUNICATIONS INC.**

# **SERVICE MANUAL**

**ON CALL ALERT RECEIVER**

## **MODEL MCA-611**

1-2 SPECIFICA

## DECODER

Frequency range..... 208 Hz - 3906 Hz  
(continuously adjustable)  
Audio input impedance..... greater than 10K ohm

6dB bandwidth..... 20 Hz

### Inputs -

A0 audio input..... .2 - 1vrms  
D12 RST input (MCA-611 only)..... 9V max.  
K5 Microphone hang-up..... 0v (enable) open (reset)

### Outputs -

D0 MSG lamp driver (MICRO-COM 2-way only)..... 30ma sink  
D11 MSG latch Q output (MCA-611 only)..... 13ma source  
K7 sq. control (MICRO-COM 2-way only)..... 15ma source

Sensitivity (decoder with audio)..... 12dB sinad 100% detect  
..... 6dB sinad 75% detect

## 1-5 INSTALLATION

### Mobile 12 VDC Installation:

The MCA 611 is designed for mobile installation in any vehicle that has a 12 VDC negative ground system. The red lead with the fuseholder must be connected to the positive terminal side of the battery. In the event that the battery is remotely located, it may be necessary to install additional wires or pick up +V from some other location in the vehicle's electrical system. Ground may be picked up from the optional mounting hardware but a hard wired ground to the phillips head screw on the back of the chassis is preferred.

Remove the antenna by rotating it counter clockwise. Install an MA-5 antenna splitter so the MCA 611 can share the vehicle's built-in antenna with the existing radio. Mount the bracket MA-63 to any convenient location and screw the radio into position with the two knurled knobs.

### Battery Installation:

Remove the antenna by rotating it counter clockwise; remove the two knurled knobs and pull the case off. Place the connector end of the battery (MA-181) gently between the spring retainers and slide it forward until it makes good contact. Then attach the battery retaining bracket on the back of the battery and "snug" it forward until the battery is held firmly; tighten the bracket screw.

### Crystal Installation:

The following Regency Part Number crystals are used:

Low VHF: 301-542  
High VHF: 301-532  
UHF: 301-603

Crystal socket X201 (XTL socket furthest from speaker) corresponds to the "normal" position of the front panel frequency select switch. X201's band select pin is on the anode of CR209. The band is selected by putting the other end of the jumper pin on one of the following pins, depending on the required frequency.

|               |               |
|---------------|---------------|
| LL 30- 39MHz  | HH 160-170MHz |
| LH 39- 50MHz  | UL 450-470MHz |
| HL 146-160MHz | UH 475-500MHz |

X202's jumper pin is connected to the anode of CR210 and corresponds to the "alternate" frequency.

After the crystals are installed, it will be necessary to tune it up in accordance with the instructions in the service manual.

### Igniter Installation:

Two igniter drivers are provided on the main board; a pulsed drive and an unpulsed drive. The later is already wired to the bottom lug of the three terminal connector on the back panel of the radio. This makes the radio immediately compatible with the MA-24 Igniter Option.

If you require an ON-OFF feature for your igniter, simply remove the female jumper connector from Q213 and put it on the collector pin of Q212.

## 1-6 OPERATION

### Volume Control:

This control varies the audio output level for the internal speaker. It also varies the level of audio present at the external speaker connection. Moving the control up increases the Volume level.

### Squelch Control:

The squelch only works when the radio is in the monitor mode. It eliminates background noise in the absence of a signal. Full squelch is all the way down.

### Alert Monitor Switch:

In the alert mode only the properly coded signal can open the squelch. In the monitor mode any traffic on the selected frequency can be monitored.

### Frequency Switch:

This selects either F1 or F2.

### Duty Switch:

Used only with an MA-301 option, otherwise it is left in the "Normal" position. This switch would allow an appropriately equipped radio to decode either AB and AC or ZE and ZF. (An internal connection will allow the radio to decode AB, AC AND ZE, ZF regardless of the duty switch position.

### Alert and Ex. Pwr. Light:

Steady light indicates AC Power ON.  
No light indicates radio is on battery.  
Slow Flashing - Low battery.  
Fast Flashing - a signal has been received.

### Rear Panel:

For convenience of mobile operation, we have included two +V connectors on the back of the radio; one for the vehicle's battery and one to power the igniter option MA-24. The bottom connector is for the igniter drive. In addition, there is an external speaker jack which allows for a remotely located speaker, MA-108, as well as an external antenna jack to go with the MA-5 y coupler antenna.

## 1-7 CRYSTAL SPECIFICATIONS

Due to the numerous frequencies or channels involved, the crystals are not normally installed by the factory, but by the seller or owner of the unit. The Regency part numbers are listed in Section 1-5. When ordering from another manufacturer, the following information should be provided:

1. Crystal frequency, determined as follows:

Low Band: Crystal frequency = channel frequency +10.7 MHz

Example:

$$\text{Crystal frequency} = 39.5 \text{ MHz} = 50.2 \text{ MHz} - 10.7 \text{ MHz}$$

High Band: Crystal frequency =  $\frac{\text{channel frequency} - 10.7 \text{ MHz}}{3}$

Example:

$$\text{Crystal frequency} = \frac{155.55 \text{ MHz} - 10.7 \text{ MHz}}{3} = \frac{144.85 \text{ MHz}}{3}$$

48.2833 MHz

UHF Band; Crystal frequency =  $\frac{\text{channel frequency} - 10.7 \text{ MHz}}{9}$

Example:

$$\text{Crystal frequency} = \frac{458.0 \text{ MHz} - 10.7 \text{ MHz}}{9} = \frac{447.30 \text{ MHz}}{9}$$

49.70000 MHz

2. Frequency tolerance of 0.001% on High Band and UHF Band, 0.002% on Low Band.
3. UHF Band - 3rd overtone, load capacity of 18pf; drive level of 2 milliwatts.
4. VHF Bands - 3rd overtone, series resonance minus 450 Hz.
5. Maximum impedance of 35 ohms.
6. Holder is an HC-25/U with pin leads (plug-in type).

## SECTION 2 CIRCUIT DESCRIPTION

### 2-1 CRYSTAL SELECT CIRCUIT

The two crystals X201 and X202 are selected by jumpering pins on the anodes of CR209 and CR210 to the appropriate pin corresponding to the frequency divisions on the device specification page. When a band is selected, bias is applied to the appropriate front end by causing the associated diodes to conduct through the frequency selector switch SW401 to ground.

When the UH Pin is selected, ground is applied to R229 and R224 thus biasing the UHF amp and mixer. In all cases except the LH select case, the low band varactors are held close to ground by CR223, 222 and 221. When the UL Pin is selected the tuning varactors CR205 and CR206 have a variable bias through R243.

By selecting any other band the AFC which is only needed for the UHF is disabled by diodes CR215 and CR218.

Selecting HH applies ground to the High VHF RF amp Q203 and mixer Q204 bias resistors. Varactors CR203 and CR204 are at +8 volts. Selecting HL grounds R250 providing variable bias to those diodes, (CR203 and CR204).

Selecting LH grounds R203 and R216 and puts 8 volts on the cathodes of CR201 and CR202. Selecting LL grounds CR201 and CR202.

### 2-2 RF FRONT END

Q201 is the Low Band VHF amplifier. Varactor tuning is used in the input and output circuits to determine whether the circuits are tuned to the upper or lower segment of the low band. The RF signal from Q201 is coupled to the input of the low band mixer Q202.

Q203 is the High Band VHF RF amplifier. The input circuit is double-tuned. Varactor tuning is used to tune both parts of the double-tuned circuits to determine whether the circuits are tuned to the upper or lower segments of the high band. The RF output signal from Q203 is coupled to the input of the high band mixer Q204.

Q205 is the VHF RF amplifier. Varactor tuning is used in the input and output to determine whether the circuits are tuned to the upper or lower segments of the UHF band.

### 2-3 OSCILLATOR/MULTIPLIER

Q208 is the crystal controlled local oscillator. The fundamental frequency of the crystal is taken from the emitter circuit for low band VHF injection. The third harmonic of the crystal frequency is taken from the collector circuit for high band injection. When operating on UHF, the third harmonic of the crystal frequency at the collector of Q208 is coupled to a frequency tripler Q207 which multiplies the frequency by three for UHF injection. Q207 is turned on only for UHF operation. The fundamental frequency of the crystal is multiplied by nine for UHF injection.

## 2-4 I.F.

The first I.F. frequency 10.7 MHz, from any one of the mixers, is fed through XF201 (a monolithic crystal filter) to the input of IC201 (Pin 18). Between Pins 18 and 3 is the second I.F. mixer circuit. Crystal X203 is used to generate the second L.O. frequency (10.245 MHz) used to mix with the 10.7 MHz I.F. to produce the second I.F. frequency 455 KHz. The 455 KHz signal at Pin 3 of IC201 is fed through CF201, a narrow band ceramic filter centered at 455 KHz, to Pin 5 of IC201. Between Pins 5 and 10 of IC201, there are amplifiers, limiters and a quadrature detector circuit. The adjustable quadrature coil is connected between Pins 8 and 4 of IC201.

## 2-5 AUDIO

The demodulated audio from Pin 10 is de-emphasized by R262 and C265 and capacitively coupled through the squelch switch Q209 to the audio amplifier IC202. The squelch amp and squelch switch are inside IC201. A logical low on Pin 14 (audio being received) sets Pin 16 High thereby providing bias to Q209 and allowing audio to pass into IC202. A High on Pin 14 of IC201 (noise) produces a low on Pin 16, IC201, grounding the bias current on Q209 and squelching the audio. The noise level at which the squelch switch engages is controlled by R403, the squelch control.

## 2-6 TWO-TONE SEQUENTIAL DECODER

Audio enters at A0 and is limited by CR301 and CR302. The audio is then filtered by a high-Q digital filter and the amplified output appears at Pin 1 of IC304. The voltage has to be 4 vpp in order to trigger the detector in IC303. The audio is further amplified by IC304 and the output Pin 7, IC304 is fed to the harmonic detector of IC303 (Pin 5). The harmonic detector will stop the decoder from detecting any harmonics of the tone to be decoded.

When the correct tone is present, the detector output, after being delayed, fires a one-shot. The one shot time constant is set by R316, R317 and C313 and can be varied by R317 to fit the user's particular inter-tone timing.

The digital filter itself is an 8-pole filter. The filtered output frequency is determined from the clock frequency. The relationship is  $f_{\text{clock}}/8 = f_{\text{filter}}$ .

The clocks are gated from either Pin 1 of IC301 or IC302, depending on whether it is the first or second tone to be decoded. The clock is selected by the oscillator switch output of IC303.

Tone A (the first to be decoded) is selected by the adjustment of R301. Similarly Tones B and C are set by grounding manually Pin 7, IC302 via JO301 and setting the second tone and then ungrounding it to set the third using the trimming potentiometers R320 and R318, respectively.

When Tone A is received, the one-shot is fired. Oscillator switch 1 is grounded and oscillator switch 2 goes high (.5v). IC302 is now the clock source and IC301 is used to alternate between the two clocks for Tones B and C, by alternately grounding and ungrounding Pin 7 of IC302 gating first the clocks for Tone B and the Tone C into IC303. The period of oscillation on Pin 7 of IC302 is 200ms.

When the second tone has been received (Tone B or Tone C) before the one-shot has timed out, the latch is set and D11 is grounded. This causes Pin 14 of IC201 to go low turning off that the squelch switch, which turns on Q209 thus unsquelching the radio.

## 2-7 LAMP LOGIC AND IGNITER DRIVES

When a signal is decoded and Pin D11 goes low, it sets the latch Pin 6, IC206C "Low", Pin 4, IC206B "High", thereby turning on both the high rate "ALERT" flasher consisting of IC205D and IC206E and the two igniter drives. The user may select, via a jumper pin, which drive he requires either pulsed or unpulsed. The low on Pin 6, IC206C disables both the AC on logic consisting of IC204A and the low battery indicator consisting of IC204B.

IC206F and IC205C are the slow light logic circuits for the low battery indicator.. All of the logic elements activate the LED on the front panel by forward biasing Q211 into conduction.

## 2-8 DECODER RESET

Resetting the decoder is accomplished by driving Pin 13 of IC303 to less than 1V for at least 25ms. This may be done in three ways; the carrier controlled reset, the time out reset and front panel switch SW405. The front panel switch is the only way to reset both the signal light and the decoder.

A jumper is installed at the factory from JU-D15 to JU-D13. This allows the decoder to reset in the absence of a carrier so that it can be ready to decode the next message. The flashing light indicating that the radio has already received a message must be reset manually via SW405.

To monitor the radio traffic for 30 sec to 3 minutes after a message has been received, switch the jumper from JU-D15 to JU-D14 and set the RC timing network R293 for the time you desire. When the circuit has timed out, Q214 will stop conducting making the base of Q304 go high causing it to conduct and thereby resetting the decoder. Again the flashing light will remain on until manually reset to let the user know a message has been received.

When the second time has been received (from 2 or from 3) before the one-  
the radio.

2-7. The radio is connected to the power supply by means of a cable.  
The radio is connected to the power supply by means of a cable.  
The radio is connected to the power supply by means of a cable.

2-8. The radio is connected to the power supply by means of a cable.  
The radio is connected to the power supply by means of a cable.

2-9. The radio is connected to the power supply by means of a cable.  
The radio is connected to the power supply by means of a cable.

2-10. The radio is connected to the power supply by means of a cable.  
The radio is connected to the power supply by means of a cable.

2-11. The radio is connected to the power supply by means of a cable.  
The radio is connected to the power supply by means of a cable.

2-12. The radio is connected to the power supply by means of a cable.  
The radio is connected to the power supply by means of a cable.

2-13. The radio is connected to the power supply by means of a cable.  
The radio is connected to the power supply by means of a cable.

## SECTION 3

### ALIGNMENT PROCEDURE



|       |             |         |           |             |          |          |
|-------|-------------|---------|-----------|-------------|----------|----------|
| REV A | APPLICATION |         | REVISIONS |             |          |          |
|       | NEXT ASSY   | USED ON | REV       | DESCRIPTION | DATE     | APPROVED |
|       |             |         | A         | R-204       | 11-12-79 | ISAP     |

SH  
TP-14-254  
DWG. NO.

FINAL TEST PROCEDURE  
MCA 611 ON CALL ALERT RECEIVER

A. R.F. Alignment Procedure

I. Test Set-Up

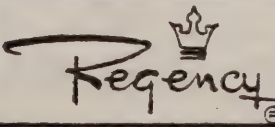
A. Equipment

1. F.M. Signal Generator
2. AC VTVM capable of measuring 455 KHz
3. DC Voltmeter

Note: If a radio has two crystals in the same band, a frequency midway between them should be used for the tune-up procedure so that the RF amp will be broad tuned. The anode of CR209 must be jumpered to the spare pin on the anode of CR210 and then jumpered to the correct band pin (LL, UH, HH, etc.). If the radio uses both bands of a given preselector, tune the upper range to a middle frequency first, then switch to the lower range and check the mid band sensitivity there. In the case of UHF adjust R243 to achieve rated sensitivity and for high VHF adjust R250 to achieve the lower band sensitivity. For the low VHF bands tune for the best combined sensitivity. Some compromise in sensitivity may be necessary between any two bands. If only one frequency is being used for a given preselector then tune up the radio for best sensitivity on that particular frequency.

B. Radio Preset

1. Connect DC power supply to DC power connection, top pin of 3-pin connector on the back of the radio. (The DC power supply can be substituted by using the radio's own AC supply; 117V 60Hz.)
2. Set radio controls as follows:
  - a. Volume - comfortable listening level
  - b. Squelch - upper most slide position
  - c. Alert/monitor switch - in monitor position

|                                                                                                                       |                   |                |                                                                                                                                            |              |      |
|-----------------------------------------------------------------------------------------------------------------------|-------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------|------|
| UNLESS OTHERWISE SPECIFIED<br>DIMENSIONS ARE IN INCHES.<br>TOLERANCES ARE<br><br>FRACT. DEC ANG.<br>± .XX± ±<br>.XXX± | APPROVALS         | DATE           |  COMMUNICATIONS INC.<br>SATELLITE BEACH, FLORIDA 32937 |              |      |
|                                                                                                                       | DRAWN             |                |                                                                                                                                            |              |      |
|                                                                                                                       | CHECKED           |                |                                                                                                                                            |              |      |
|                                                                                                                       | DFTG. SUPV.       |                |                                                                                                                                            |              |      |
| MATERIAL                                                                                                              | ENGR. <i>ISAP</i> | <i>11/2/79</i> | FINAL TEST PROCEDURE                                                                                                                       |              |      |
|                                                                                                                       |                   |                | MCA 611 ON CALL ALERT RECEIVER                                                                                                             |              |      |
| FINISH                                                                                                                |                   |                | SIZE                                                                                                                                       | PART NUMBER  | REV. |
|                                                                                                                       |                   |                | A                                                                                                                                          | TP-14-254    | A    |
| DO NOT SCALE DRWG.                                                                                                    |                   |                | SCALE                                                                                                                                      | SHEET 1 OF 8 |      |

- d. Duty Switch - in normal position
- e. Frequency switch - on frequency to be aligned
- f. On/Off switch - in ON position

### 3. Install crystals

- a. Put crystal in socket X201 (XTL socket farthest from speaker). X201 corresponds to "normal" freq.
- b. Run band select jumper from anode of CR209 to the correct range select pin.
- c. X202 corresponds to the two band select pins farthest from speaker.

|                |                |
|----------------|----------------|
| LL 30-39 MHz   | HH 160-170 MHz |
| LH 39-50 MHz   | UL 450-470 MHz |
| HL 146-160 MHz | UH 475-500 MHz |

### C. Quadrature Alignment

1. With no signal applied, put the DC Voltmeter's probe on Pin 10 of IC201 (A0 Pin) and adjust L216 until the voltage is 3.5 volts.

### D. I.F. Alignment

1. Connect the FM Signal Generator to the antenna input jack. Accurately set the frequency to the center of the channel being used for alignment. Modulate the Signal Generator with 1,000 Hz, 3K KHz deviation.
2. Connect the AC Voltmeter to Pin 5 of IC201 (foil side of board).
3. Set AC Voltmeter to the 100mv scale.
4. Adjust the Signal Generator output until the AC Voltmeter reading is mid-range.
5. Adjust L208 for maximum AC Voltmeter reading. Re-adjust the Signal Generator's output to maintain voltmeter reading near mid-range.

Note: If the RF segments refuse to tune up or will not allow full rated sensitivity, check the position of the band select pin with respect to the frequency of the crystal and the band select jumper.

With the frequency select switch SW401 in the normal position crystal X201 (farthest from speaker) and the pin closest to speaker are "turned on".

### E. Low VHF Segment (30-50 MHz)

1. Connect AC Voltmeter to Pin 5, IC201.
2. Set AC Voltmeter to the 100 millivolt scale.
3. Make sure band select pins are set up as per Note.
4. Set the Signal Generator accurately to the frequency of the channel being used for alignment. Connect the generator's output to the antenna input jack. Adjust Signal Generator's output until AC Voltmeter reading is mid-range.
5. Adjust L201 and L206 for maximum AC Voltmeter reading. Re-adjust Signal Generator's output to maintain voltmeter

|                                  |                      |          |             |          |
|----------------------------------|----------------------|----------|-------------|----------|
| DRAWN                            | DATE                 | SIZE     | PART NUMBER | REV.     |
| APPROVED <i>Bernard J. Brown</i> | DATE <i>11/12/79</i> | <i>A</i> | TP-14-254   | <i>A</i> |
| DO NOT SCALE DWG.                |                      | SCALE    | SHEET 2     |          |

reading near mid-range. Repeat adjustments until no further improvements can be made.

F. High VHF Segment (146-170 MHz)

1. Connect AC Voltmeter to Pin 5, IC201.
2. Set AC Voltmeter to the 100 millivolt scale.
3. Make sure the band select pins are set up as per Note.
4. Set the Signal Generator accurately to the frequency being used for alignment. Connect generator's output to antenna input jack. Adjust Signal Generator's output until AC Voltmeter reading is mid-range.
5. Adjust L203 and L205 for maximum AC Voltmeter reading. Re-adjust Signal Generator's output to maintain voltmeter reading near mid-range.
6. Now adjust L209 and L211 and repeat all adjustments until no further improvement can be made.

G. UHF Segment (450-500 MHz)

1. Connect AC Voltmeter to Pin 5, IC201.
2. Set AC Voltmeter to the 100 millivolt scale.
3. Make sure the band select pins are set up as per Note.
4. Set the Signal Generator accurately to the frequency being used for alignment. Connect generator's output to antenna input jack. Adjust Signal Generator's output until AC Voltmeter reading is mid-range.
5. Adjust C226, C228 and C245 in that order for maximum AC Voltmeter reading. Re-adjust Signal Generator's output to maintain voltmeter reading near mid-range. Repeat adjustments until no further improvement can be made.

Note: If sensitivity is poor (greater than .7mv) or if sensitivity varies more than 3dB while AFC voltage is varied from 1 to 7 volts, detune L211 two turns CCW.

H. AFC Alignment

1. With the unit on a channel with a UHF crystal and no RF input, adjust L216 for a voltmeter reading of approximately 3.8 volts at the junction of R253 and R249. Its setting should be within a turn of the setting in the quadrature alignment.

B. Carrier Reset Option (See Note on Page 4)

1. Set alert/monitor switch into monitor position.
2. With no RF signal applied, adjust squelch for desired squelching action.
3. Return alert/monitor switch back to the alert position.

|                                 |                      |       |             |         |
|---------------------------------|----------------------|-------|-------------|---------|
| DRAWN                           | DATE                 | SIZE  | PART NUMBER | REV.    |
| APPROVED <i>Bern A. Pearson</i> | DATE <i>11/12/77</i> | A     | TP-14-254   | A       |
| DO NOT SCALE DWG.               |                      | SCALE |             | SHEET 3 |

4. Apply enough RF signal to quiet the receiver and signal the unit with proper two-tone sequence.
5. The squelch should open allowing the listener to hear the remainder of the second tone's duration and the message lamp should flash at a high rate.
6. Turn off applied RF signal so that the radio goes into the squelched mode. The decoder is now reset and no signal other than the proper two-tone sequence will open the squelch.
7. The MSG LED should remain flashing until the reset switch is moved into the reset position.

C. Time-Out Reset Option

1. Unsolder the factory installed carrier reset jumper from JU-D15 and solder it to JU-D14 (collector of Q214).
2. Turn up RF signal enough to quiet the receiver.
3. Modulate the Signal Generator with the proper two-tone sequence.
4. The squelch should open, allowing the receiver to operate normally for a given period of time. This time period can be adjusted by varying R293. The MSG LED will be flashing at a very fast rate and will remain flashing when the decoder has been reset.
5. The MSG LED can be reset by pushing the reset switch to the right.

D. Battery Voltage Warning Adjustment  
(for battery equipped models only)

1. Place a DC Voltmeter probe on test point M1 and adjust R296 for 4.0 volts. The slow flash rate alarm will trigger when the battery voltage reaches approximately 9.9 volts.

E. Igniter Drive (used with MA-24)

1. A jumper (factory installed) runs from the bottom solder lug of the three terminal connector on the rear panel to the collector of Q212.
2. To provide a pulsed output, simply pull the pin from Q213 and put it on the collector pin of Q212.

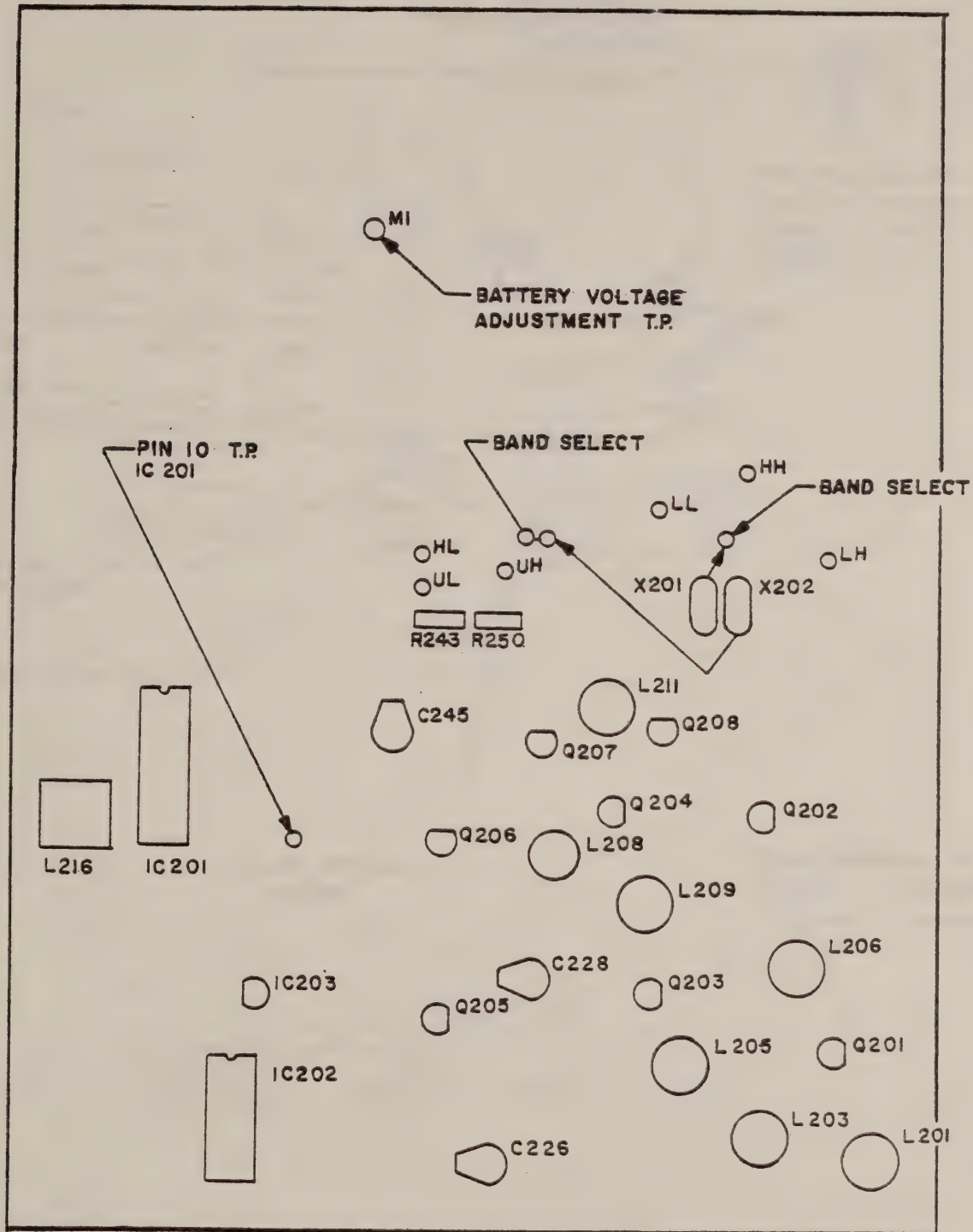
F. Acceptable Performance Limits

Sensitivity .48 $\mu$ v worst case  
Audio power . 5 watt

Note: Carrier reset should not be used in areas of low signal strength, as it will decrease the radio's decode sensitivity to around 12dB sinad. If this is the case in your area, use time-out reset.

|                                |               |      |             |         |
|--------------------------------|---------------|------|-------------|---------|
| DRAWN                          | DATE          | SIZE | PART NUMBER | REV.    |
| APPROVED <i>Tom C. Pearson</i> | DATE 11/12/79 | A    | TP-14-254   | A       |
| DO NOT SCALE DWG.              | SCALE         |      |             | SHEET 4 |

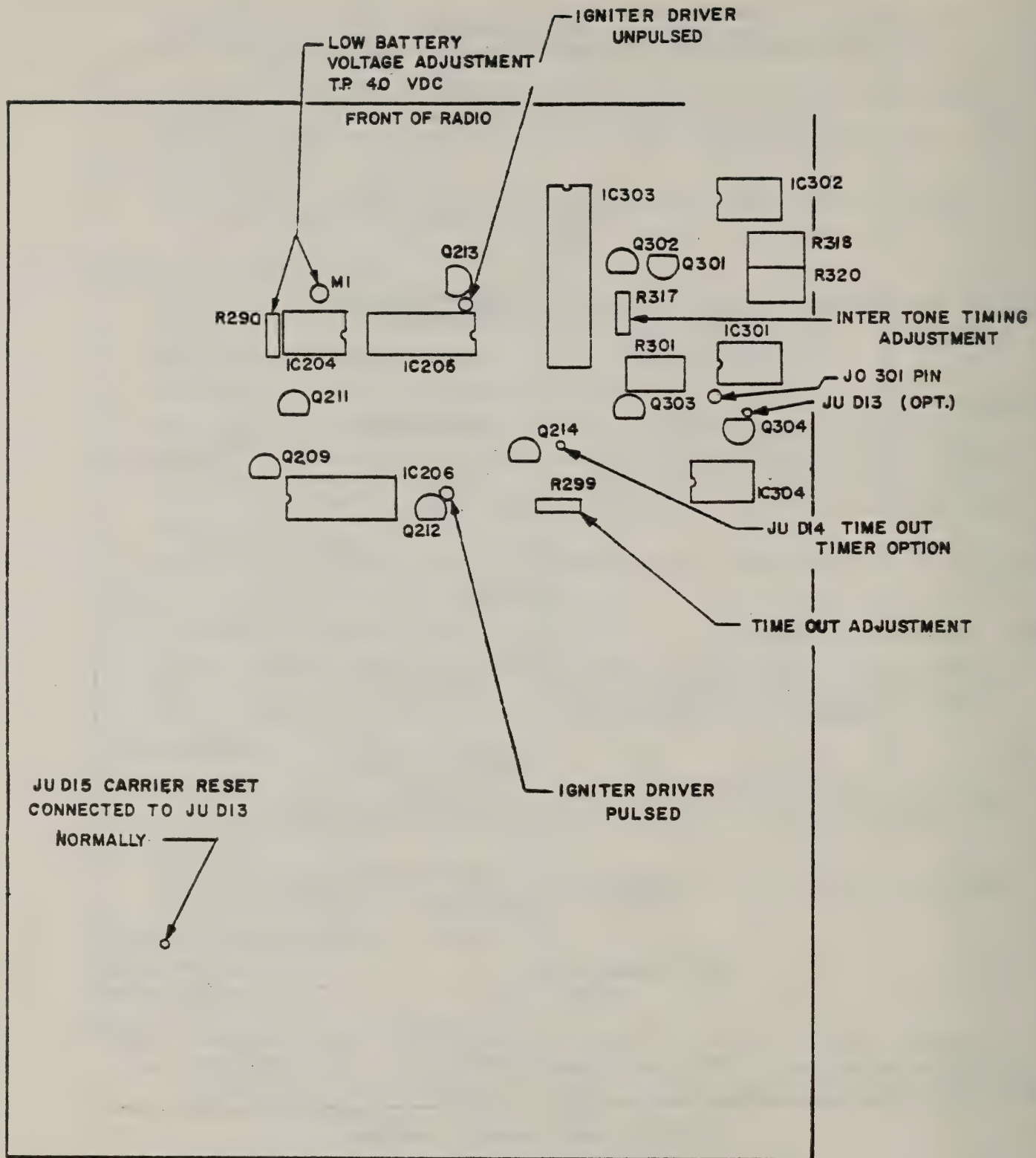
# FRONT OF RADIO



## RECEIVER AND CHRYSTAL SECTION

FIGURE 1

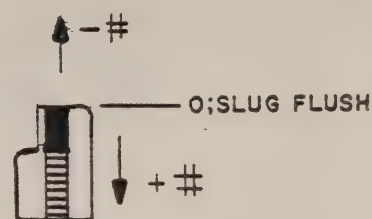
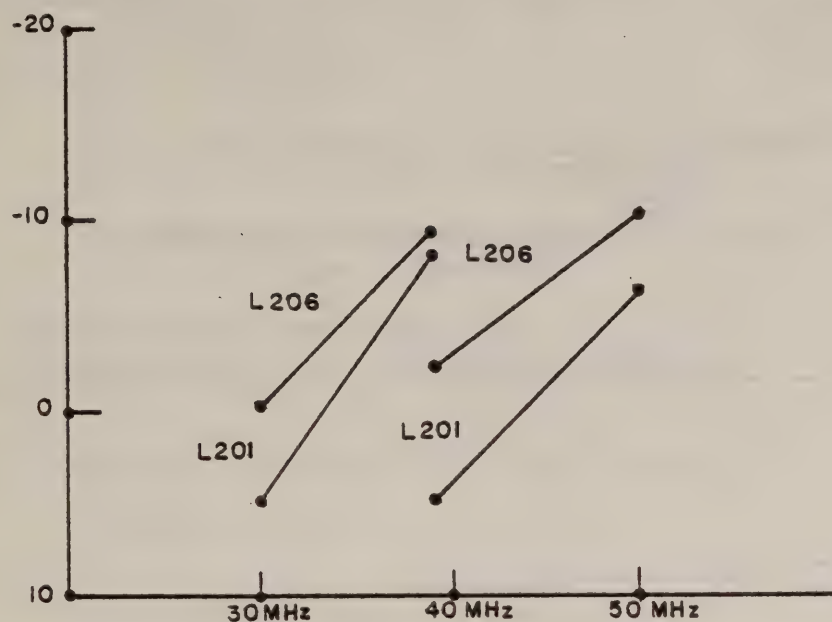
|                                  |               |       |             |      |
|----------------------------------|---------------|-------|-------------|------|
| DRAWN                            | DATE          | SIZE  | PART NUMBER | REV. |
| APPROVED <i>John A. T. Brown</i> | DATE 11/12/71 | A     | TP14-254    | A    |
| DO NOT SCALE DWG.                |               | SCALE | SHEET 5     |      |



DIGITAL FILTER, IGNITER DRIVES, LOW BATT. INDICATOR,  
CARRIER, TIME OUT RESET

FIGURE 2

|                                    |                      |      |             |         |
|------------------------------------|----------------------|------|-------------|---------|
| DRAWN                              | DATE                 | SIZE | PART NUMBER | REV.    |
| APPROVED <i>Bernard C. Pearson</i> | DATE <i>11/12/72</i> | A    | TP14-254    | A       |
| DO NOT SCALE DW'G.                 | SCALE                |      |             | SHEET 6 |



POSITIVE NUMBERS ARE COUNTED AS NUMBER OF TURNS CLOCKWISE FROM FLUSH POSITION.

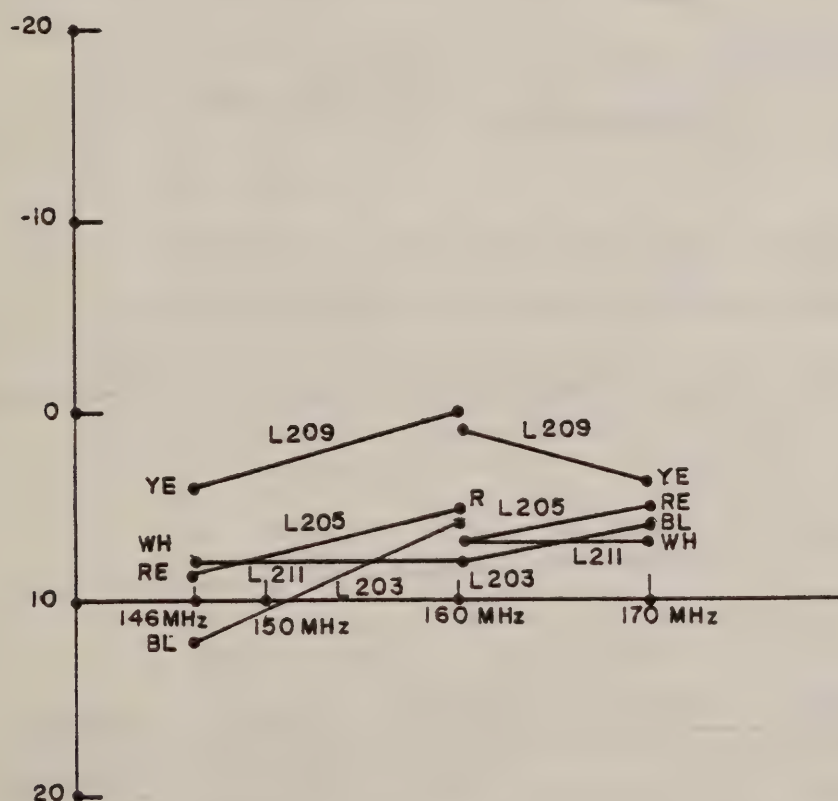
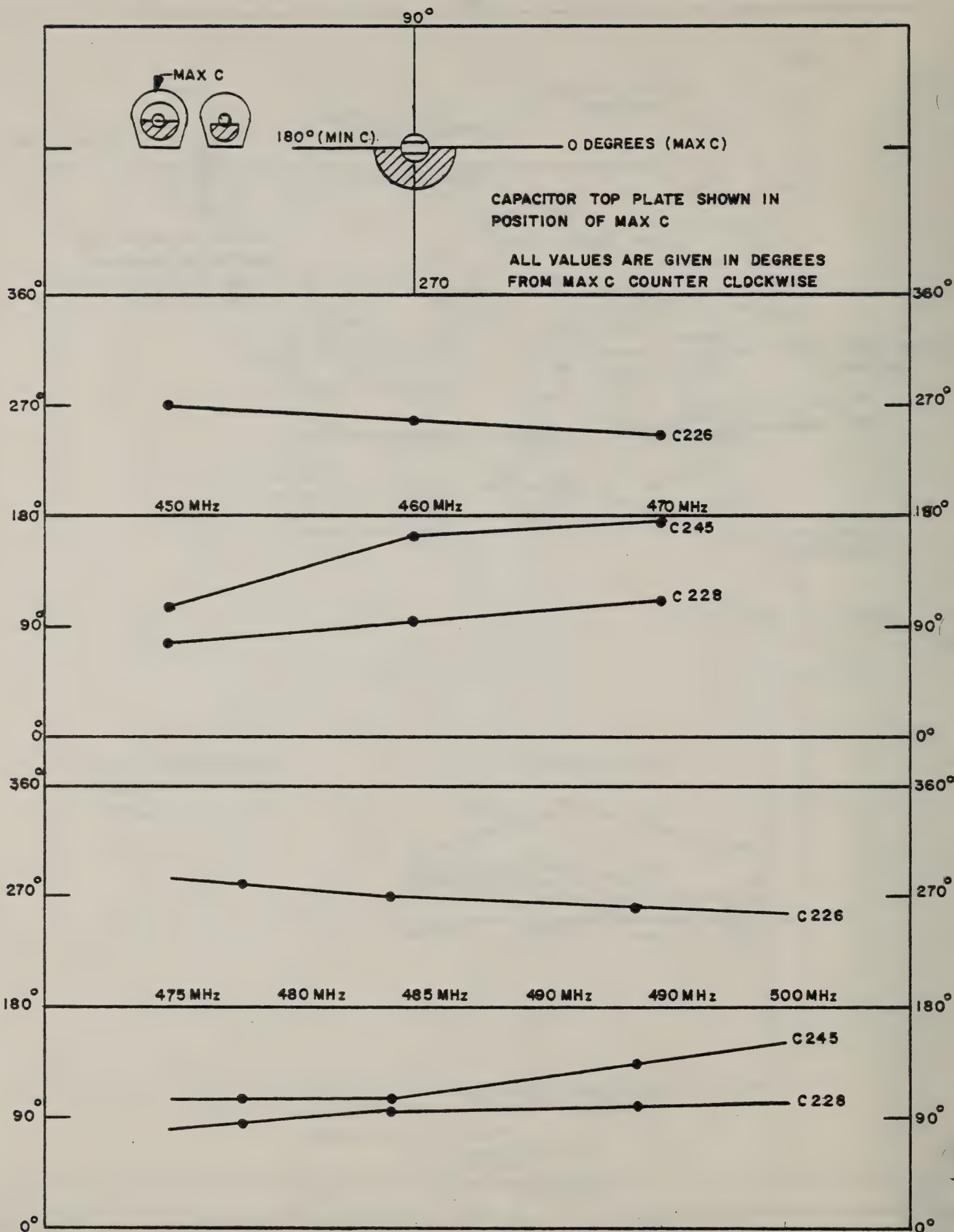


FIGURE 3

|                             |              |      |             |         |
|-----------------------------|--------------|------|-------------|---------|
| DRAWN                       | DATE         | SIZE | PART NUMBER | REV.    |
| APPROVED <i>[Signature]</i> | DATE 11/1/71 | A    | TP14-254    | A       |
| DO NOT SCALE DWG.           |              |      | SCALE       | SHEET 7 |



UHF TUNING CHART

FIGURE 4

| APPLICATION |         | REVISIONS |             |          |          |
|-------------|---------|-----------|-------------|----------|----------|
| NEXT ASSY   | USED ON | REV       | DESCRIPTION | DATE     | APPROVED |
|             |         | A         | R-165       | 10/26/79 | ISAP     |

TEST PROCEDURE

TWO-TONE SEQUENTIAL DECODER

(APPLIED TO MCA-611)

I. Sequential Tone Decoder Set-Up and Testing


A. Equipment required

1. R.F. Signal Generator
2. Two-Tone Sequential Generator
3. High input Impedance Amplifier\*
4. Frequency Counter\*
5. Power Supply (13-16 VDC)

\*Note: In place of a high input Impedance Amplifier and a Frequency Counter, an Oscilloscope with an accurate time base may be used to set up the clock frequencies.

B. Radio Preset

1. Connect DC power supply to DC power connection, top pin of 3-pin connector on the back of the radio. (The DC power supply can be substituted by using the radio's own AC supply; 117V 60Hz.)
2. Set radio controls as follows:
  - a. Volume - comfortable listening level.
  - b. Squelch - upper most slide position.
  - c. Alert/monitor switch - in alert position.
  - d. Duty switch - in normal position.
  - e. Frequency switch - in normal position.
  - f. On/Off switch - in ON position.
3. Set the frequency of the RF signal generator to the normal crystal frequency (the frequency of the crystal in the socket farthest from the speaker).

|                                                                                                                                    |                   |              |                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNLESS OTHERWISE SPECIFIED<br>DIMENSIONS ARE IN INCHES.<br>TOLERANCES ARE<br><br>FRACT. DEC      ANG.<br>±    .xx±      ±<br>.xxx± | APPROVALS         | DATE         |  COMMUNICATIONS INC.<br>SATELLITE BEACH, FLORIDA 32937                                                                                       |
|                                                                                                                                    | DRAWN             |              |                                                                                                                                                                                                                                  |
|                                                                                                                                    | CHECKED           |              |                                                                                                                                                                                                                                  |
|                                                                                                                                    | DFTG. SUPV.       |              |                                                                                                                                                                                                                                  |
| MATERIAL                                                                                                                           | ENGR. <i>ISAP</i> | <i>11/25</i> | TEST PROCEDURE -<br><br>TWO-TONE SEQUENTIAL DECODER -                                                                                                                                                                            |
| FINISH                                                                                                                             |                   |              | <div style="display: flex; justify-content: space-between;"> <div>           SIZE <b>A</b> </div> <div>           PART NUMBER<br/>           TP14-219         </div> <div>           REV.<br/>           A         </div> </div> |
| DO NOT SCALE DRWG.                                                                                                                 | SCALE             |              | SHEET <u>1</u> OF 6                                                                                                                                                                                                              |

4. Externally modulate the RF signal generator with the two-tone oscillator, making sure each tone is modulated at 3KHz deviation.

C. Clock adjustments

1. Using a frequency counter -
  - a. Connect a high input impedance amplifier to Pin 1 of IC301 in the radio.
  - b. Connect the output of the amplifier to the input of an accurate frequency counter.
  - c. Adjust R301 until the counter reads eight times the value of the first tone (Tone A).
  - d. Remove the end of JO301 that connects with Pin 1 of IC301 and let that end hang free.
  - e. Disconnect the probe of the amplifier going to Pin 1 of IC301 and connect it to Pin 1 of IC302.
  - f. Adjust R318 until a frequency of eight times tone frequency B is read on the frequency counter.
  - g. Ground the end of JO301 leading to Pin 7 of IC302.
  - h. Adjust R320 until eight times the frequency of Tone C is read on the frequency counter.
  - i. Replace JO301 on the pin.

2. Using an oscilloscope -

- a. Connect probe of oscilloscope to Pin 1 of IC301. Set vertical sensitivity to .1v per division.
- b. Adjust R302 so that the period of the oscillation displayed on the oscilloscope is as follows:

$$t_{oscA} = 1/(8 \times f_A), \text{ where } f_A \text{ is the frequency of Tone A}$$

- c. Put in enough signal to quiet the receiver and modulate the signal generator with just Tone A. The oscilloscope will now be switching between a high and a low frequency oscillation.
- d. Now connect the oscilloscope to Pin 1 of IC302. You will observe two different oscillator frequencies being switched at about 100ms rate.
- e. One oscillation period will vary with the adjustment of R318. Adjust this period to -

$$t_{oscB} = 1/(8 \times f_B), \text{ where } f_B \text{ is the frequency of Tone B}$$

- f. The other oscillation period is adjusted by R320. Adjust R320 for a period to -

$$T_{oscC} = 1/(8 \times f_C), \text{ where } f_C \text{ is the frequency of Tone C}$$

|                                    |                      |          |             |          |
|------------------------------------|----------------------|----------|-------------|----------|
| DRAWN                              | DATE                 | SIZE     | PART NUMBER | REV.     |
| APPROVED <i>Bernard A. Pearson</i> | DATE <i>11/12/77</i> | <b>A</b> | TP14-219    | <b>A</b> |
| DO NOT SCALE DWG.                  |                      | SCALE    | SHEET       |          |
|                                    |                      |          | 2           |          |

#### D. Adjusting the Inter-Tone Timing

1. Modulate RF signal generator with Tone A.
2. Connect oscilloscope to Pin 17 of IC303.
3. Adjust R317 for this period.

One shot period - period of 1st tone + period delay + period 2nd tone.

4. Modulate RF signal with the two-tone sequence.
5. The message light will come on and the squelch will open.

Example: Suppose the following frequencies were needed:

TONE A - 349.0

TONE B - 389.0

TONE C - 410.8

Using an accurate frequency counter -

The reading at Pin 1 of IC301 must be adjusted to  $8 \times 349.0 \text{ Hz} = 2,792 \text{ Hz}$ .

The adjustment is done with R301.

The order of the next two Tones B and C is unimportant.

With the probe on Pin 2 of IC302 and J0301 pulled up, adjust R318 for eight times one of the other tones - say Tone C,  $8 \times 410.8 \text{ Hz} = 3,286.4 \text{ Hz}$ . Now ground the jumper against the case and adjust R320 for  $8 \times 389.0 \text{ Hz} = 3,112 \text{ Hz}$ .

Now adjust the inter-tone timing according to your requirements. Suppose the period of the first tone is .75 sec. and the period between tones is .5 sec the final tone is also .75 sec, then

One shot period = period of 1st tone + period delay + period 2nd tone  
 $= .75\text{s} + .5\text{s} + .75\text{s} = 2\text{s}$

The adjustment is made with R317 and set with the scope probe on Pin 17 of IC303.

To do the same example problem with an oscilloscope instead of a frequency counter -

$$t_{\text{osca}} = \frac{1}{8 \times f_A} = 358 \times 10^{-6}$$

Set the scope for about  $50 \times 10^{-6} \text{ s/Div}$

Then divide  $\frac{358 \times 10^{-6} \text{ s}}{50 \times 10^{-6} \text{ s/Div}} = 7.16 \text{ Div} - \text{for one cycle}$

The other two tones are set in the same fashion.

|                              |                      |       |             |         |
|------------------------------|----------------------|-------|-------------|---------|
| DRAWN                        | DATE                 | SIZE  | PART NUMBER | REV.    |
| APPROVED <i>Boon C. Boon</i> | DATE <i>11/12/71</i> | A     | TP14-219    | A       |
| DO NOT SCALE DWG.            |                      | SCALE |             | SHEET 3 |

## E. Unit Testing

1. With Carrier Reset Option -
  - a. Set alert/monitor switch into monitor position.
  - b. With no RF signal applied, adjust squelch for desired squelching action.
  - c. Return alert/monitor switch back to the alert position.
  - d. Apply enough RF signal to quiet the receiver and signal the unit with the proper two-tone sequence.
  - e. The squelch should open allowing the listener to hear the remainder of the second tone's duration and the message lamp should flash at a high rate.
  - f. Turn off applied RF signal so that the radio goes into the squelched mode. The decoder is now reset and no other signal other than the proper two-tone sequence will open the squelch.
  - g. The MSG LED should remain flashing until the reset switch is moved into the reset position.
2. With Time-Out Reset Option -
  - a. Turn up RF signal enough to quiet the receiver.
  - b. Modulate the signal generator with the proper two-tone sequence.
  - c. The squelch should open, allowing the receiver to operate normally for a given period of time. This time period can be adjusted by varying R293. The MSG LED will be flashing at a very fast rate and will remain flashing when the decoder has been reset.
  - d. The MSG LED can be reset by pushing the reset switch to the right.

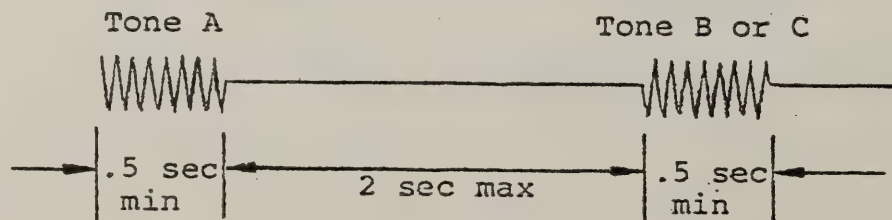
## F. Acceptable Performance Limits

|                             |                        |
|-----------------------------|------------------------|
| Frequency Range *           | 208 - 3,906 Hz         |
| Frequency Counter will read | 1,664.- 31,248.        |
| Decoder Sensitivity         | 12dB Sinad 100% detect |
|                             | 6dB Sinad 75% detect   |

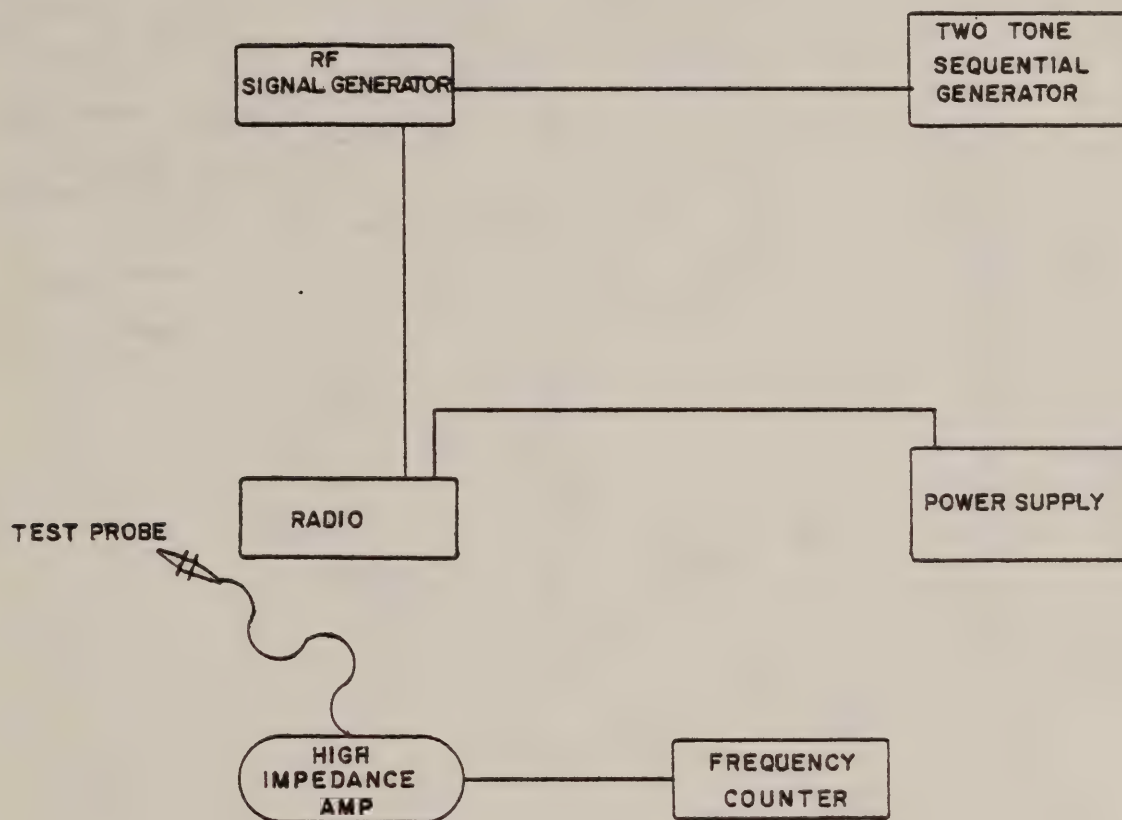
Audio Input at Pin 6 of IC303  
must be 1.3Vpp or greater

\*For tone frequencies lower than 300 Hz it may be necessary to change C301, C316 or C317 respectively to 820pf. for those oscillators below 300 Hz only.

## PROPER TONE SEQUENCE



|                                    |                  |           |                         |           |
|------------------------------------|------------------|-----------|-------------------------|-----------|
| DRAWN                              | DATE             | SIZE<br>A | PART NUMBER<br>TP14-219 | REV.<br>A |
| APPROVED<br><i>John A. Pearson</i> | DATE<br>11/17/71 | SCALE     | SHEET<br>4              |           |
| DO NOT SCALE DWG.                  |                  |           |                         |           |



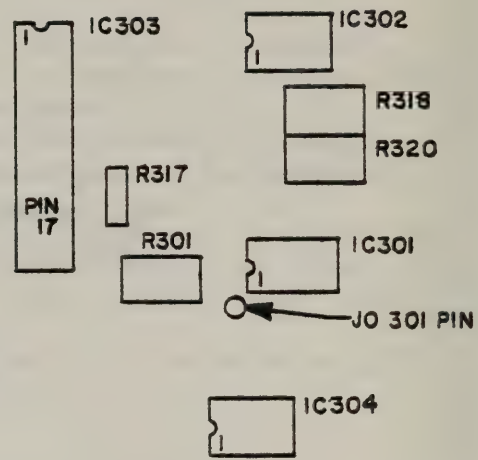
TEST INTERCONNECTION DIAGRAM

FIGURE - 1

|                                 |               |           |                         |            |
|---------------------------------|---------------|-----------|-------------------------|------------|
| DRAWN                           | DATE          | SIZE<br>A | PART NUMBER<br>TP14-219 | REV.<br>A  |
| APPROVED <i>Bern A. Pearson</i> | DATE 11/12/72 |           |                         |            |
| DO NOT SCALE DWG.               | SCALE         |           |                         | SHEET<br>5 |

DWG. NO. TP14-219  
 REV. A  
 6

FRONT OF RADIO



TWO TONE DECODER

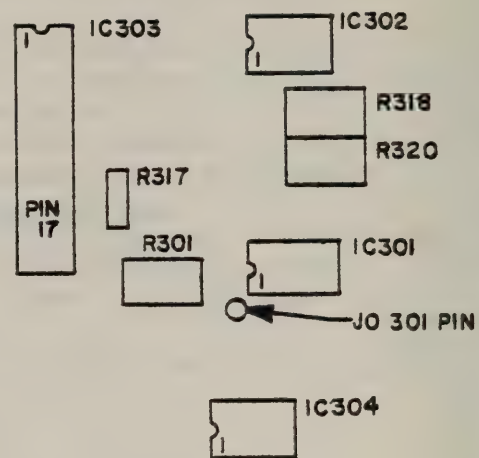
FIGURE - 2

|                                   |               |      |             |         |
|-----------------------------------|---------------|------|-------------|---------|
| DRAWN                             | DATE          | SIZE | PART NUMBER | REV.    |
| APPROVED <i>T. J. [Signature]</i> | DATE 11/12/70 | A    | TP14-219    | A       |
| DO NOT SCALE DWG.                 | SCALE         |      |             | SHEET 6 |



TP14-219  
DWG. NO.

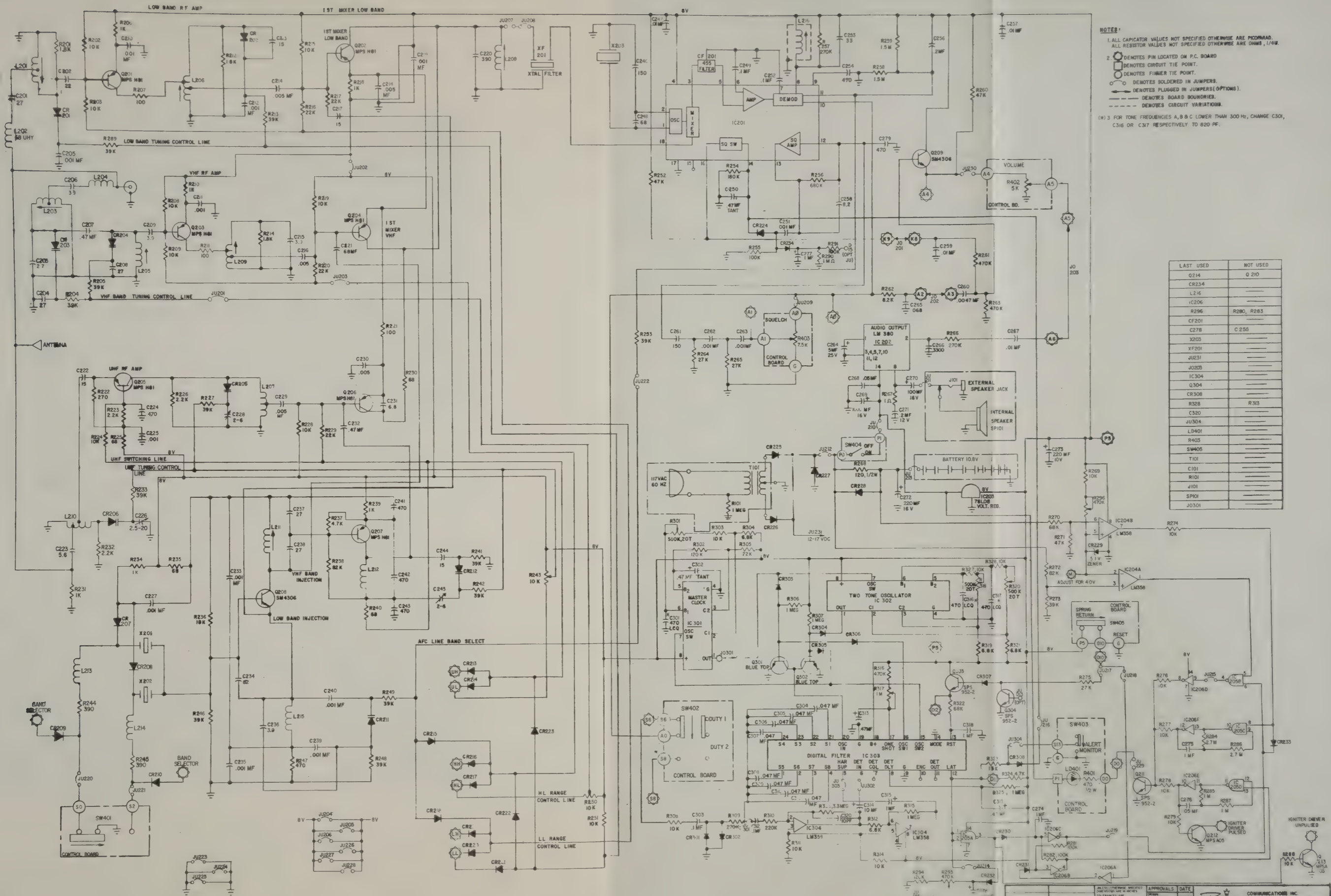
FRONT OF RADIO



TWO TONE DECODER

FIGURE - 2

|                             |               |       |             |      |
|-----------------------------|---------------|-------|-------------|------|
| DRAWN                       | DATE          | SIZE  | PART NUMBER | REV. |
| APPROVED <i>[Signature]</i> | DATE 11/12/79 | A     | TP14-219    | A    |
| DO NOT SCALE DWG.           |               | SCALE | SHEET 6     |      |



- NOTES:**
1. ALL CAPACITOR VALUES NOT SPECIFIED OTHERWISE ARE MICROFARADS.
  2. ALL RESISTOR VALUES NOT SPECIFIED OTHERWISE ARE OHMS, 1/4W.
  3. DENOTES PIN LOCATED ON P.C. BOARD
  4. DENOTES CIRCUIT TIE POINT.
  5. DENOTES FINGER TIE POINT.
  6. DENOTES SOLDERED IN JUMPER.
  7. DENOTES PLUGGED IN JUMPER (OPTION).
  8. DENOTES BOARD BOUNDARIES.
  9. DENOTES CIRCUIT VARIATIONS.
- (N) 3 FOR TONE FREQUENCIES A, B & C LOWER THAN 300 HZ, CHANGE C301, C316 OR C317 RESPECTIVELY TO 820 PF.

| LAST USED | NOT USED   |
|-----------|------------|
| Q214      | Q 210      |
| CR234     |            |
| L216      |            |
| IC206     |            |
| R296      | R280, R283 |
| CF201     |            |
| C278      | C 258      |
| X203      |            |
| XF201     |            |
| JU231     |            |
| JU205     |            |
| IC304     |            |
| Q304      |            |
| CR308     |            |
| R328      | R 313      |
| C320      |            |
| JU304     |            |
| LD401     |            |
| R403      |            |
| SW405     |            |
| T101      |            |
| C101      |            |
| R101      |            |
| J101      |            |
| SP101     |            |
| J0301     |            |

|                                                                             |  |                                                                         |  |
|-----------------------------------------------------------------------------|--|-------------------------------------------------------------------------|--|
| ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED<br>DATE 3/15/98 BY 104-070 |  | APPROVALS DATE<br>COMMUNICATIONS INC.<br>SATELLITE BEACH, FLORIDA 32957 |  |
| MCA 611<br>NEXT ASSY USED ON                                                |  | Schematic<br>MCA 611 MAIN BOARD<br>704-070                              |  |
| APPLICATION                                                                 |  | DO NOT SCALE DIM.                                                       |  |

1000.000

0000000000

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(1)

(1)

(1)





3-5

BOTTOM VIEW

## SECTION 4

## PARTS LIST

RECEIVERCAPACITORS

| <u>LOCATION</u> | <u>DESCRIPTION</u>  | <u>PART NUMBER</u> |
|-----------------|---------------------|--------------------|
| C201            | 27pf 10 NPO 50V     | 1500-0270-650      |
| C202            | 22pf 10 NPO 500V    | 1500-0220-605      |
| C203            | 2.7pf NPO 500V      | 1500-0279-205      |
| C204            | 27pf 10 NPO 50V     | 1500-0270-650      |
| C205            | .001 mf +8-2 50V    | 1503-0102-003      |
| C206            | 3.9pf 10 NPO 500V   | 1500-0399-905      |
| C207            | .47pf 10 Type MC    | 1510-0478-900      |
| C208            | 27pf 10 NPO 50V     | 1500-0270-650      |
| C209            | 3.9pf 10 NPO 500V   | 1500-0399-905      |
| C210            | .001mf +8-2 50V     | 1503-0102-003      |
| C211            | .001mf +8-2 50V     | 1503-0102-003      |
| C212            | .001mf +8-2 50V     | 1503-0102-003      |
| C213            | 15pf 10 NPO 500V    | 1500-0150-605      |
| C214            | .005mf +8-2 50V     | 1503-0502-005      |
| C215            | 3.9pf 10 NPO 500V   | 1500-0399-905      |
| C216            | .005mf +8-2 50V     | 1503-0502-005      |
| C217            | 15pf 10 NPO 500V    | 1500-0150-605      |
| C218            | .005mf +8-2 50V     | 1503-0502-005      |
| C219            | .001mf +8-2 50V     | 1503-0102-003      |
| C220            | 390pf 50V 5 LCQ-17  | 1506-0391-550      |
| C221            | .68pf 10 Type MC209 | 1510-0688-900      |
| C222            | 15pf 10 NPO 500V    | 1500-0150-605      |
| C223            | 5.6pf 10 NPO 500V   | 1500-0569-905      |
| C224            | 470 pf 20 50V Z5F   | 1523-0471-002      |
| C225            | .001mf +8-2 50V     | 1503-0102-003      |
| C226            | Trim 2.5 -20pf      | 1517-0000-034      |
| C227            | .001mf +8-2 50V     | 1503-0102-003      |
| C228            | Trim 2-6pf          | 1517-0000-035      |
| C229            | .005mf +8-2 50V     | 1503-0502-005      |
| C230            | .005mf +8-2 50V     | 1503-0502-005      |
| C231            | 6.8pf 10 NPO 500V   | 1500-0689-905      |
| C232            | .47pf 10 Type MC    | 1510-0478-900      |
| C233            | .001mf +8-2 50V     | 1503-0102-003      |
| C234            | 82pf 5 NPO 50V      | 1524-0820-002      |
| C235            | .001mf +8-2 50V     | 1503-0102-003      |
| C236            | 3.9pf 10 NPO 500V   | 1500-0399-905      |
| C237            | 27pf 10 NPO 50V     | 1500-0270-650      |
| C238            | 27pf 10 NPO 50V     | 1500-0270-650      |
| C239            | .001mf +8-2 50V     | 1503-0102-003      |
| C240            | .001mf +8-2 50V     | 1503-0102-003      |
| C241            | 470pf 20 50V Z5F    | 1523-0471-002      |
| C242            | 470pf 20 50V Z5F    | 1523-0471-002      |
| C243            | 470pf 20 50V Z5F    | 1523-0471-002      |
| C244            | 15pf 10 NPO 500V    | 1500-0150-605      |
| C245            | Trim 2-6pf          | 1517-0000-035      |
| C246            | 150pf 50V 5 LCQ-17  | 1506-0151-550      |
| C247            | .01mf +8-2 50V      | 1503-0103-007      |
| C248            | 68pf 5 NPO 50V      | 1524-0680-002      |
| C249            | .1mf +8-2 50V       | 1503-0104-010      |
| C250            | .47mf 15V 20        | 1515-0478-003      |

| <u>LOCATION</u> | <u>DESCRIPTION</u>   | <u>PART NUMBER</u> |
|-----------------|----------------------|--------------------|
| C251            | .001mf 10 100V       | 1508-0102-610      |
| C252            | .1mf +8-2 50V        | 1503-0104-010      |
| C253            | 33pf 10 NPO 500V     | 1500-0330-605      |
| C254            | 470pf 20 50V Z5F     | 1523-0471-002      |
| C255            | not used             |                    |
| C256            | .2mf+8-2 12V         | 1502-0204-006      |
| C257            | .01mf +8-2 50V       | 1503-0103-007      |
| C258            | 8.2pf 10 NPO 500V    | 1500-0829-905      |
| C259            | .01mf +8-2 50V       | 1503-0103-007      |
| C260            | .0047mf 10 100V      | 1508-0472-610      |
| C261            | 150pf 5 50V LCQ-17   | 1506-0151-550      |
| C262            | .001mf 10 100V       | 1508-0102-610      |
| C263            | .001mf 10 100V       | 1508-0102-610      |
| C264            | 5mf 25V Type U       | 1513-0050-003      |
| C265            | .068mf 10 100V       | 1508-0683-610      |
| C266            | .0033mf 10 100V      | 1508-0332-610      |
| C267            | .01mf +8-2 50V       | 1503-0103-007      |
| C268            | .05mf +8-2 25V       | 1502-0503-003      |
| C269            | 1000mf 15V Type U    | 1513-0102-002      |
| C270            | 100mf 16V 85D Type U | 1513-0101-002      |
| C271            | .2mf +8-2 12V        | 1502-0204-006      |
| C272            | 220mf 16V 85D        | 1513-0221-002      |
| C273            | 220mf 10V 85D Type U | 1513-0221-001      |
| C274            | .1uf +80-20 12V      | 1502-0104-006      |
| C275            | .1pf +80-20 12V      | 1502-0104-006      |
| C276            | .05mf +8-2 25V       | 1501-0503-003      |
| C277            | 1mf 15V 20 tant      | 1515-0010-003      |
| C278            | 220mf 10V 85D Type U | 1513-0221-002      |

## COIL

|      |                    |               |
|------|--------------------|---------------|
| L201 | coil               | 1800-3152-013 |
| L202 | choke .68uhy Wilco | 1802-0688-003 |
| L203 | coil TMRH RF Ant   | 1800-3152-001 |
| L204 | choke LM-2         | 1803-5125-903 |
| L205 | RF Input           | 1800-3152-002 |
| L206 | coil               | 1800-3152-012 |
| L207 | coil               | 1800-3160-006 |
| L208 | coil RF (Wht)      | 1800-3191-401 |
| L209 | coil               | 1800-3152-014 |
| L210 | Loop (T)           | 1800-3160-004 |
| L211 | coil               | 1800-3152-009 |
| L212 | Osc 450MHz         | 1800-3160-003 |
| L213 | choke 12 uhy       | 1803-1313-100 |
| L214 | choke 12 uhy       | 1803-1313-100 |
| L215 | coil TMR           | 1801-1236-900 |
| L216 | coil               | 1800-6055-801 |

# INTEGRATED CIRCUITS

| <u>LOCATION</u> | <u>DESCRIPTION</u> | <u>PART NUMBER</u> |
|-----------------|--------------------|--------------------|
| IC201           | IF Sub Sys         | 3130-6056-500      |
| IC202           | Nat LM 380N        | 3130-3157-614      |
| IC203           | 78-L08 8V          | 3130-0000-014      |
| IC204           | LM358N             | 3130-3167-909      |
| IC205           | MC14011 CP         | 3130-3157-628      |
| IC206           | MM 74C04N          | 3130-3157-617      |

## RESISTORS

(All resistors are  $\frac{1}{4}$ W 5% unless otherwise noted)

|      |         |               |
|------|---------|---------------|
| R201 | 1.8K    | 4704-0182-032 |
| R202 | 10K     | 4704-0103-032 |
| R203 | 10K     | 4704-0103-032 |
| R204 | 39K     | 4704-0393-032 |
| R205 | 39K     | 4704-0393-032 |
| R206 | 1K      | 4704-0102-032 |
| R207 | 100 ohm | 4704-0101-032 |
| R208 | 10K     | 4704-0103-032 |
| R209 | 10K     | 4704-0103-032 |
| R210 | 1K      | 4704-0102-032 |
| R211 | 100 ohm | 4704-0101-032 |
| R212 | 1.8K    | 4704-0182-032 |
| R213 | 39K     | 4704-0393-032 |
| R214 | 1.8K    | 4404-0182-032 |
| R215 | 10K     | 4704-0103-032 |
| R216 | 22K     | 4704-0223-032 |
| R217 | 22K     | 4704-0223-032 |
| R218 | 1K      | 4704-0102-032 |
| R219 | 10K     | 4704-0103-032 |
| R220 | 22K     | 4704-0223-032 |
| R221 | 100 ohm | 4704-0101-032 |
| R222 | 270 ohm | 4704-0271-032 |
| R223 | 2.2K    | 4704-0222-032 |
| R224 | 10K     | 4704-0103-032 |
| R225 | 68 ohm  | 4704-0680-032 |
| R226 | 2.2K    | 4704-0222-032 |
| R227 | 39K     | 4704-0393-032 |
| R228 | 10K     | 4704-0103-032 |
| R229 | 22K     | 4704-0223-032 |
| R230 | 68 ohm  | 4704-0680-032 |
| R231 | 1K      | 4704-0102-032 |
| R232 | 2.2K    | 4704-0222-032 |
| R233 | 39K     | 4704-0393-032 |
| R234 | 1K      | 4704-0102-032 |
| R235 | 68 ohm  | 4704-0680-032 |
| R236 | 10K     | 4704-0103-032 |
| R237 | 4.7K    | 4704-0472-032 |
| R238 | 82K     | 4704-0823-032 |
| R239 | 1K      | 4704-0102-032 |
| R240 | 68 ohm  | 4704-0680-032 |
| R241 | 39K     | 4704-0393-032 |
| R242 | 39K     | 4704-0393-032 |
| R243 | 10K var | 4751-0103-002 |
| R244 | 390 ohm | 4704-0391-032 |

| <u>LOCATION</u> | <u>DESCRIPTION</u> | <u>PART NUMBER</u> |
|-----------------|--------------------|--------------------|
| R245            | 390 ohm            | 4704-0391-032      |
| R246            | 39K                | 4704-0393-032      |
| R247            | 470 ohm            | 4704-0471-032      |
| R248            | 39K                | 4704-0393-032      |
| R249            | 39K                | 4704-0393-032      |
| R250            | 10K var            | 4751-0103-002      |
| R251            | 10K                | 4704-0103-032      |
| R252            | 47K                | 4704-0473-032      |
| R253            | 39K                | 4704-0393-032      |
| R254            | 180K               | 4704-0184-032      |
| R255            | 100K               | 4704-0104-032      |
| R256            | 680K               | 4704-0684-032      |
| R257            | 270K               | 4704-0274-032      |
| R258            | 1.5 meg            | 4704-0155-032      |
| R259            | 1.5 meg            | 4704-0155-032      |
| R260            | 47K                | 4704-0473-032      |
| R261            | 470K               | 4704-0474-032      |
| R262            | 8.2K               | 4704-0822-032      |
| R263            | 470K               | 4704-0474-032      |
| R264            | 27K                | 4704-0273-032      |
| R265            | 27K                | 4704-0273-032      |
| R266            | 270K               | 4704-0274-032      |
| R267            | 3.3 ohm            | 4704-0339-032      |
| R268            | 120 ohm 1/2W 5%    | 4704-0121-034      |
| R269            | 10K                | 4704-0103-032      |
| R270            | 68K                | 4704-0683-032      |
| R271            | 47K                | 4704-0473-032      |
| R272            | 68K                | 4704-0683-032      |
| R273            | 27K                | 4704-0273-032      |
| R274            | 10K                | 4704-0103-032      |
| R275            | 27K                | 4704-0273-032      |
| R276            | 10K                | 4704-0103-032      |
| R277            | 10K                | 4704-0103-032      |
| R278            | 10K                | 4704-0103-032      |
| R279            | 10K                | 4704-0103-032      |
| R280            | not used           |                    |
| R281            | 100K               | 4704-0104-032      |
| R282            | 100K               | 4704-0104-032      |
| R283            | not used           |                    |
| R284            | 2.7 meg            | 4704-0275-032      |
| R285            | 1 meg              | 4704-0105-032      |
| R286            | 2.7 meg            | 4704-0275-032      |
| R287            | 1 meg              | 4704-0105-032      |
| R288            | 10K                | 4704-0103-032      |
| R289            | 39K                | 4704-0393-032      |
| R290            | 1 meg              | 4704-0105-032      |
| R291            | 100K               | 4704-0104-032      |
| R292            | 1 meg              | 4704-0105-032      |
| R293            | 470K var           | 4751-0474-002      |
| R294            | 120K               | 4704-0124-032      |
| R295            | 470K               | 4704-0474-032      |
| R296            | 470K var           | 4751-0474-002      |

## TRANSISTORS

| <u>LOCATION</u> | <u>DESCRIPTION</u> | <u>PART NUMBER</u> |
|-----------------|--------------------|--------------------|
| Q201            | MPS H81 PNP        | 4801-0000-026      |
| Q202            | MPS H81 PNP        | 4801-0000-026      |
| Q203            | MPS H81 PNP        | 4801-0000-026      |
| Q204            | MPS H81 PNP        | 4801-0000-026      |
| Q205            | MPS H81 PNP        | 4801-0000-026      |
| Q206            | MPS H81 PNP        | 4801-0000-026      |
| Q207            | MPS H81 PNP        | 4801-0000-026      |
| Q208            | SM-4306-5          | 4801-0000-100      |
| Q209            | SPS-952-2          | 4801-0000-016      |
| Q210            | not used           |                    |
| Q211            | SPS-952-2          | 4801-0000-016      |
| Q212            | MPS A05            | 4801-0000-005      |
| Q213            | MPS A05            | 4801-0000-005      |
| Q214            | SPS-952-2          | 4801-0000-016      |

## DIODES

|       |                    |               |
|-------|--------------------|---------------|
| CR201 | MV1172             | 4809-0000-001 |
| CR202 | MV1172             | 4809-0000-001 |
| CR203 | MV2201             | 4809-0000-004 |
| CR204 | MV2201             | 4809-0000-004 |
| CR205 | MV2201             | 4809-0000-004 |
| CR206 | MV2201             | 4809-0000-004 |
| CR207 | IN4148             | 4805-1241-200 |
| CR208 | IN4148             | 4805-1241-200 |
| CR209 | IN4148             | 4805-1241-200 |
| CR210 | IN4148             | 4805-1241-200 |
| CR211 | MV1172             | 4809-0000-001 |
| CR212 | MV2201             | 4809-0000-004 |
| CR213 | IN4148             | 4809-1241-200 |
| CR214 | IN4148             | 4809-1241-200 |
| CR215 | IN4148             | 4809-1241-200 |
| CR216 | IN4148             | 4809-1241-200 |
| CR217 | IN4148             | 4809-1241-200 |
| CR218 | IN4148             | 4809-1241-200 |
| CR219 | IN4148             | 4809-1241-200 |
| CR220 | IN4148             | 4809-1241-200 |
| CR221 | IN4148             | 4809-1241-200 |
| CR222 | IN4148             | 4809-1241-200 |
| CR223 | IN4148             | 4809-1241-200 |
| CR224 | IN4148             | 4809-1241-200 |
| CR225 | IN4002             | 4806-0000-004 |
| CR226 | IN4002             | 4806-0000-004 |
| CR227 | IN4002             | 4806-0000-004 |
| CR228 | IN4002             | 4806-0000-004 |
| CR229 | Zener 5.1V IN5231B | 4808-0000-031 |
| CR230 | IN4148             | 4805-1241-200 |
| CR231 | IN4148             | 4805-1241-200 |
| CR232 | IN4148             | 4805-1241-200 |
| CR233 | IN4148             | 4805-1241-200 |
| CR234 | IN4148             | 4805-1241-200 |

| <u>LOCATION</u>       | <u>DESCRIPTION</u>     | <u>PART NUMBER</u> |
|-----------------------|------------------------|--------------------|
| <u>CRYSTAL</u>        |                        |                    |
| X203                  | Crystal 10.245 MHz     | 2301-3151-601      |
| <u>CRYSTAL FILTER</u> |                        |                    |
| XF201                 | Xtal filt. 2P 10.7 MHz | 2705-3232-200      |
| <u>CERAMIC FILTER</u> |                        |                    |
| CF201                 | Cer filter CFU455D2    | 2700-3209-500      |

## DECODER

### CAPACITORS

| <u>LOCATION</u> | <u>DESCRIPTION</u>      | <u>PART NUMBER</u> |
|-----------------|-------------------------|--------------------|
| C301            | 470pf 50V LCQ-17        | 1506-0471-550      |
| C302            | .47mf 15V 20            | 1515-0478-003      |
| C303            | .1mf 50V +8-2 Y5B       | 1503-0104-010      |
| C304            | .047mf 100V 10          | 1508-0473-610      |
| C305            | .047mf 100V 10          | 1508-0473-610      |
| C306            | .047mf 100V 10          | 1508-0473-610      |
| C307            | .047mf 100V 10          | 1508-0473-610      |
| C308            | .047mf 100V 10          | 1508-0473-610      |
| C309            | .047mf 100V 10          | 1508-0473-610      |
| C310            | .047mf 100V 10          | 1508-0473-610      |
| C311            | .047mf 100V 10          | 1508-0473-610      |
| C312            | .1uf 12V +80-20 BC-12   | 1502-0104-006      |
| C313            | .1mf 15V                | 1515-0010-003      |
| C314            | 10mf 10V 85D III Type U | 1513-0100-001      |
| C315            | 1mf 16V 85D III Type U  | 1513-0010-002      |
| C316            | 470pf 50V LCQ-17        | 1506-0471-550      |
| C317            | 470pf 50V LCQ-17        | 1506-0471-550      |
| C318            | 1mf 15V 20 T360         | 1515-0010-003      |
| C319            | .47mf 15V 20            | 1515-0478-003      |
| C320            | 10pf NPO 500V           | 1501-0100-001      |

### INTEGRATED CIRCUITS

|       |                        |               |
|-------|------------------------|---------------|
| IC301 | 2 tone osc SC74204     | 3130-6060-700 |
| IC302 | 2 tone osc SC74204     | 3130-6060-700 |
| IC303 | 2 tone dig fil SC74203 | 3130-6062-000 |
| IC304 | LM358N                 | 3130-3167-909 |

### RESISTORS

|      |          |               |
|------|----------|---------------|
| R301 | 500K var | 4751-5429-005 |
| R302 | 120K     | 4704-0124-032 |
| R303 | 10K      | 4704-0103-032 |
| R304 | 6.8K     | 4704-0682-032 |
| R305 | 22K      | 4704-0223-032 |
| R306 | 1 meg    | 4704-0105-032 |
| R307 | 1 meg    | 4704-0105-032 |
| R308 | 10K      | 4704-0103-032 |
| R309 | 270K     | 4704-0274-032 |
| R310 | 220K     | 4704-0224-032 |
| R311 | 10K      | 4704-0103-032 |
| R312 | 6.8K     | 4704-0682-032 |
| R313 | not used |               |
| R314 | 10K      | 4704-0103-032 |

| <u>LOCATION</u> | <u>DESCRIPTION</u> | <u>PART NUMBER</u> |
|-----------------|--------------------|--------------------|
| R315            | 1 meg              | 4704-0105-032      |
| R316            | 470K               | 4704-0474-032      |
| R317            | 1 meg var          | 4751-0105-002      |
| R318            | 500K var           | 4751-5429-005      |
| R319            | 6.8K               | 4704-0682-032      |
| R320            | 500K var           | 4751-5429-005      |
| R321            | 6.8K               | 4704-0682-032      |
| R322            | 68K                | 4704-0683-032      |
| R323            | 15K                | 4704-0153-032      |
| R324            | 4.7K               | 4704-0472-032      |
| R325            | 1 meg              | 4704-0105-032      |
| R326            | 3.3 meg            | 4704-0335-032      |
| R327            | 10K                | 4704-0103-032      |
| R328            | 10K                | 4704-0103-032      |

### TRANSISTORS

|      |                   |               |
|------|-------------------|---------------|
| Q301 | SPS 1476 Blue Top | 4801-0000-003 |
| Q302 | SPS 1476 Blue Top | 4801-0000-003 |
| Q303 | SPS-952-2         | 4801-0000-016 |
| Q304 | SPS-952-2         | 4801-0000-016 |

### DIODES

|       |            |               |
|-------|------------|---------------|
| CR301 | IN4148     | 4805-1241-200 |
| CR302 | IN4148     | 4805-1241-200 |
| CR303 | Diode Germ | 4807-1233-900 |
| CR304 | Diode Germ | 4807-1233-900 |
| CR305 | Diode Germ | 4807-1233-900 |
| CR306 | Diode Germ | 4807-1233-900 |
| CR307 | IN4148     | 4805-1241-200 |
| CR308 | IN4148     | 4805-1241-200 |

# CONTROL BOARD

## RESISTORS

(All resistors are  $\frac{1}{2}$ W 5% unless otherwise noted)

|      |                         |               |
|------|-------------------------|---------------|
| R401 | 470 ohm $\frac{1}{2}$ W | 4704-0471-034 |
| R402 | 5K var                  | 4752-5135-302 |
| R403 | 7.5K var                | 4752-5135-307 |

## SWITCHES

|       |                    |               |
|-------|--------------------|---------------|
| SW401 | switch, slide SPDT | 5113-3231-601 |
| SW402 | switch, slide SPDT | 5113-3231-601 |
| SW403 | switch, slide      | 5113-5135-203 |
| SW404 | switch, slide      | 5113-5135-203 |
| SW405 | switch SPDT        | 5113-3231-501 |

## DIODE

|       |               |               |
|-------|---------------|---------------|
| LD401 | Diode LED Red | 4810-1282-900 |
|-------|---------------|---------------|

CHASSIS

| <u>LOCATION</u> | <u>DESCRIPTION</u> | <u>PART NUMBER</u> |
|-----------------|--------------------|--------------------|
| R101            | resistor 1 meg     | 4701-0105-044      |
| T101            | transformer        | 5604-5100-600      |
| SP101           | spkr 2 x 6 8 ohm   | 1301-5101-000      |



LOCATION

DESCRIPTION

DATE

1001

1001-1001-1001

1001-1001-1001

1002

1002-1002-1002

1002-1002-1002

1003

1003-1003-1003

1003-1003-1003